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EXAMINER	
KRAIG, WILLIAM F	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

TH

Office Action Summary	Application No.	Applicant(s)
	10/799,961	HOFFMAN ET AL.
	Examiner	Art Unit
	William Kraig	2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 August 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,6-18 and 20-56* is/are pending in the application.

4a) Of the above claim(s) *21-36 and 45-47* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,6-18,20,37-44 and 48-56* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. Applicant's amendment to the title of the invention is acknowledged by the Examiner, and the Examiner's objection thereto is withdrawn.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-20, 37-44 and 48-57 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The claims contain references to a formula of the form $A_xB_xO_x$, and then further claim wherein "each x is independently a non-zero number" and further specific ratios of the variable x. However, as it is known in the art, a formula of the form $A_xB_xO_x$ inherently possesses a ratio of the values of x (1:1), and the values of x cannot, by their very nature be considered to be independent, nor can they be considered to have a ratio other than 1:1. The Examiner will examine the claims with the assumption that each value of x can be different, but suggests a change to a formula such as $A_xB_yO_z$, etc, for clarity.

3. The Examiner's rejection of claims 2, 5, 7, 9, 11, 13, 15, 17, 50, 52, 54 and 56 under 35 U.S.C. 112, second paragraph, are withdrawn in light of Applicant's amendments to the claims dated 7/27/2007.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 2, 6-9, 18, 20, 37, 38 and 42-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamada et al. (Japan Patent # JP405251705A) in view of Phillips et al. ("Transparent Conducting Thin Films of $GaInO_3$", Appl. Phys. Let. Vol. 65 (1), July 1994) further in view of Narushima et al. ("Electronic structure and transport properties in the transparent amorphous oxide semiconductor 2 CdOGeO", Phys. Rev. B 66, 035203-1, 7/16/2002).

Regarding claim 1, Fig. 4 of Hamada et al. discloses a semiconductor device, comprising:

a drain electrode (10);

a source electrode (11);

a channel (8) contacting the drain electrode (10) and the source electrode (11), wherein the channel includes one or more compounds of the formula $A_xB_xO_x$, wherein the compound is ITO (the material comprising 8 is disclosed to be ITO (InSnO));

a gate dielectric (3) positioned between a gate electrode (9) and the channel (8).

Hamada et al., however, fails to disclose that compounds include gallium-tin oxide or that the compounds forming the channel region include one of an amorphous form and a mixed-phase crystalline form or that each x in the formula $A_xB_xO_x$ is independently a non-zero number.

Phillips et al. teaches the use of $GaIn_{1-x}Sn_xO_3$ (wherein each x in the formula is independently a non-zero number) (Page 115, Bridging Paragraph) as a replacement for a layer of ITO.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the $GaIn_{1-x}Sn_xO_3$ layer of Phillips et al. into the device of Hamada et al. The ordinary artisan would have been motivated to modify Hamada et al. in the above manner for the purpose of further lowering the conductivity of the transparent oxide semiconductor channel region of Hamada et al. and increasing the transparency of the transparent oxide semiconductor channel region. (Hamada et al., Paragraph 25) (Phillips et al., Page 117, Final Paragraph)

Hamada et al. and Phillips et al., however, fail to disclose the channel region including one of an amorphous form and a mixed-phase crystalline form.

Narushima et al. teaches that it is desirable to use amorphous transparent oxide as a semiconductor material (Narushima et al., Col. 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize an amorphous transparent oxide as is taught by Narushima et al. in the device of Hamada et al. and Phillips et al. The ordinary artisan would have been motivated to modify Hamada et al. and Phillips et al. in the above manner for the purpose of taking advantage of the high electron mobility associated with the amorphous transparent oxides and the ability of amorphous transparent oxides to be deposited on plastic, flexible substrates (Narushima et al., Col. 1).

Regarding claim 2, Hamada et al., Phillips et al. and Narushima et al. disclose the semiconductor device of claim 1, wherein the one or more compounds of the formula $A_xB_xO_x$ includes an atomic composition of metal (A)-to-metal (B) ratio of A:B, wherein proportions of A and B, based on stoichiometric x values associated with A and B are in a range of about .05 to .95 (Phillips et al. discloses $GaIn_{1-x}Sn_xO_3$ (0<=x<=20), which satisfies the limitations of this claim).

Regarding claim 6, Hamada et al., Phillips et al. and Narushima et al. disclose the semiconductor device of claim 1, wherein the one or more compounds of the formula $A_xB_xO_x$ includes C_x, wherein C is Indium ($GaIn_{1-x}Sn_xO_3$)(Phillips et al., Page 115, Bridging Paragraph)

Regarding claim 8, Hamada et al., Phillips et al. and Narushima et al. disclose the semiconductor device of claim 1, wherein the one or more compounds of the formula $A_xB_xO_x$ is gallium-indium-tin oxide (Phillips et al., Page 115, Col. 2, Top Paragraph).

Regarding claims 7 and 9, Hamada et al., Phillips et al. and Narushima et al. disclose the semiconductor devices of claims 6 and 8, wherein the one or more compounds of the formula $A_xB_xC_xO_x$ includes an atomic composition of metal (A)-to-metal (B)-to-metal (C) ratio of A:B:C, wherein proportions of A, B and C, based on stoichiometric x values associated with A, B and C are in a range of about .05 to .95 (Phillips et al. discloses $GaIn_{1-x}Sn_xO_3$ (0<=x<=20), which satisfies the limitations of this claim).

Regarding claim 18, Hamada et al., Phillips et al. and Narushima et al. disclose a semiconductor device, comprising:

a drain electrode (Hamada et al., Fig. 4 (10));

a source electrode (Hamada et al., Fig. 4 (11));

means for controlling current flow (Hamada et al., Fig. 4 (8)) to electrically coupled to the drain electrode (Hamada et al., Fig. 4 (10)) and the source electrode (Hamada et al., Fig. 4 (11)), wherein the means for controlling current flow (Hamada et al., Fig. 4 (8)) includes one or more compounds of the formula $A_xB_xO_x$, wherein the one or more compounds includes gallium-tin oxide ($GaIn_{1-x}Sn_xO_3$)(Phillips et al., Page 115, Bridging Paragraph), each x is independently a non-zero number (Phillips et al., Page 115, Bridging Paragraph) wherein the channel includes an amorphous form (Narushima et al., Col. 1); and

a gate electrode (Hamada et al., Fig. 4 (9)) separated from the channel (Hamada et al., Fig. 4 (8)) by a gate dielectric (Hamada et al., Fig. 4 (3)).

Regarding claim 20, Hamada et al., Phillips et al. and Narushima et al. disclose the semiconductor device of claim 18, wherein the source (Hamada et al., Fig. 4 (11)), drain (Hamada et al., Fig. 4 (10)), and gate (Hamada et al., Fig. 4 (9)) electrodes include a substantially transparent material (ITO).

Regarding claim 37, Hamada et al., Phillips et al. and Narushima et al. disclose a semiconductor device formed by the steps, comprising:

providing a drain electrode (Hamada et al., Fig. 4 (10));

providing a source electrode (Hamada et al., Fig. 4 (11));

depositing a channel (Hamada et al., Fig. 4 (8) including a composition (composition including one or more precursor compounds that include A_x and one or more compounds that include B_x, wherein each A is Gallium, and B is Sn)(Phillips et al., Page 115, Bridging Paragraph) to form a multicomponent oxide ($GaIn_{1-x}Sn_xO_3$)(Phillips et al., Page 115, Bridging Paragraph), (each x is independently a non-zero number (Phillips et al., Page 115, Bridging Paragraph)), wherein the channel includes an amorphous form (Narushima et al., Col. 1)) from the composition to electrically couple the drain electrode (Hamada et al., Fig. 4 (10)) and the source electrode (Hamada et al., Fig. 4 (11)) (see Fig. 4 of Hamada et al.);

providing a gate electrode (Hamada et al., Fig. 4 (9)); and

providing a gate dielectric (Hamada et al., Fig. 4 (3)) positioned between the gate electrode (Hamada et al., Fig. 4 (9)) and the channel (Hamada et al., Fig. 4 (8)).

The claim to providing a precursor composition is a product by process limitation and is given no patentable weight so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of providing a precursor composition is therefore irrelevant given that the final product of the claim is anticipated by Hamada et al., Phillips et al. and Narushima et al.

Regarding claim 38, Hamada et al., Phillips et al. and Narushima et al. disclose the semiconductor device of claim 37.

The claim to providing a precursor composition is a product by process limitation and is given no patentable weight so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of providing a precursor composition is therefore irrelevant given that the final product of the claim is anticipated by Hamada et al., Narushima et al. and Phillips et al. (See rejection of claim 6 above, wherein the combination of Hamada et al., Narushima et al. and Phillips et al. is shown to disclose GaSnInO).

Regarding claim 42, Hamada et al., Phillips et al. and Narushima et al. disclose the semiconductor device of claim 37, wherein providing the source (Hamada et al., Fig. 4 (11)), the drain (Hamada et al., Fig. 4 (10)), and the gate (Hamada et al., Fig. 4 (9)) electrodes includes providing a substantially transparent form of the source, the drain, and the gate electrodes (ITO).

Regarding claim 43, the claim to providing a liquid form of the precursor composition is a product by process limitation and is given no patentable weight so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of providing a liquid form of the precursor composition is therefore irrelevant given that the final product of the claim is anticipated by Hamada et al., Phillips et al. and Narushima et al.

Regarding claim 44, the claim to an ink-jet deposition technique for forming the channel is a product by process limitation and is given no patentable weight so long as the final product

of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular ink-jet deposition technique for forming the channel is therefore irrelevant given that the final product of the claim is anticipated by Hamada et al., Phillips et al. and Narushima et al.

5. Claims 10-13 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamada et al. (Japan Patent # JP405251705A) in view of Phillips et al. ("Transparent Conducting Thin Films of $GaInO_3$", Appl. Phys. Let. Vol. 65 (1), July 1994) further in view of Narushima et al. ("Electronic structure and transport properties in the transparent amorphous oxide semiconductor 2 CdOGeO", Phys. Rev. B 66, 035203-1, 7/16/2002) further in view of Minami ("Transparent and Conductive Multicomponent Oxide films prepared by magnetron sputtering", Minami, J. Vac. Sci. Technol. A 17(4), Jul/Aug 1999).

Regarding claim 10, Hamada et al., Phillips et al. and Narushima et al. disclose the semiconductor device of claim 6, but fail to specifically disclose the limitations added by claim 10.

Phillips et al., however, does disclose that both GaGeInO and GaInSnO are transparent conducting oxides with desirable properties (more transparent then other known TCOs).

Minami teaches that a transparent conducting oxide will always be obtained when combining oxides which are TCO film materials or transparent conductors.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Minami into the devices of Hamada et al., Phillips et al. and

Narushima et al. and combine the GaGeInO and GaInSnO of Phillips et al. to form a new multicomponent oxide. The ordinary artisan would have been motivated to modify Hamada et al., Phillips et al. and Narushima et al. in the above manner for the purpose of creating a new multicomponent oxide suitable for use as the channel of a switching device employed for use in a light emitting system because of its specific electrical, optical and chemical properties and its specific bandgap energy and workfunction, which can be controlled by altering the chemical composition (Minami, Conclusion).

The claims to a specific composition ratio of the claimed compound are considered to be an optimization of ranges. *In re Aller, Lacey, and Hall*, 105 USPQ 233 (CCPA 1955). It would have been obvious to one of ordinary skill in the art to modify the composition ratio of the claimed composition to form a composition with properties ideal for use as the channel of a switching device employed for use in a light emitting system (i.e., workfunction and transparency).

Regarding claim 12, Hamada et al., Phillips et al., Narushima et al. and Minami disclose the semiconductor device of claim 1, wherein the one or more compounds of the formula $A_xB_xO_x$ is gallium-indium-germanium-tin oxide (combination of GaInSnO and GaGeInO would result in GaInGeSnO).

Regarding claims 11 and 13, the claims to a specific composition ratio of the claimed compound are considered to be an optimization of ranges. *In re Aller, Lacey, and Hall*, 105 USPQ 233 (CCPA 1955). It would have been obvious to one of ordinary skill in the art to

modify the composition ratio of the composition to form a composition with properties ideal for use as the channel of a switching device employed for use in a light emitting system (i.e., workfunction and transparency).

Regarding claim 39, Hamada et al., Phillips et al., Narushima et al. and Minami disclose the semiconductor device of claim 38.

The claim to providing a precursor composition is a product by process limitation and is given no patentable weight so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of providing a precursor composition is therefore irrelevant given that the final product of the claim is anticipated by Hamada et al., Phillips et al., Narushima et al. and Minami (See rejection of claim 10 above, wherein the combination of Hamada et al., Phillips et al., Narushima et al. and Minami is shown to disclose GaInGeSnO).

6. Claims 14-17 and 40-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamada et al. (Japan Patent # JP405251705A) in view of Phillips et al. ("Transparent Conducting Thin Films of $GaInO_3$", Appl. Phys. Let. Vol. 65 (1), July 1994) further in view of Narushima et al. ("Electronic structure and transport properties in the transparent amorphous oxide semiconductor 2 CdOGeO", Phys. Rev. B 66, 035203-1, 7/16/2002) further in view of Minami ("Transparent and Conductive Multicomponent Oxide films prepared by magnetron sputtering", Minami, J. Vac. Sci.

Technol. A 17(4), Jul/Aug 1999), further in view of D ("Transparent Conducting PbO_2 films prepared by activated reactive evaporation", Phys. Rev. B 33,2660 - 2664 (1986)).

Regarding claims 14 and 16, Hamada et al., Phillips et al., Narushima et al. and Minami disclose the semiconductor device of claims 1 and 10, but fail to disclose the one or more compounds of formula $A_xB_xC_xD_xO_x$ including E_x, to form a compound of the formula $A_xB_xC_xD_xE_xO_x$, wherein each E is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and wherein each of A, B, C, D, and E are different.

D discloses a transparent conductive oxide semiconductor of PbO_2.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the PbO_2 of D into the device of Hamada et al., Phillips et al., Narushima et al. and Minami and combine the PbO_2 of D into the GaGeInSnO of Hamada et al., Phillips et al., Narushima et al. and Minami to form a new multicomponent oxide (GaGeInSnPbO). The ordinary artisan would have been motivated to modify Hamada et al., Phillips et al., Narushima et al. and Minami in the above manner for the purpose of creating a new multicomponent oxide suitable for use as the channel of a switching device employed for use in a light emitting system because of its specific electrical, optical and chemical properties and its specific bandgap energy and workfunction, which can be controlled by altering the chemical composition (Minami, Conclusion). The ordinary artisan would have expected a reasonable degree of success in this combination because Minami teaches that a transparent conducting oxide will always be obtained when combining oxides which are TCO film materials or transparent conductors.

The claims to a specific composition ratio of the claimed compound are considered to be an optimization of ranges. *In re Aller, Lacey, and Hall*, 105 USPQ 233 (CCPA 1955). It would have been obvious to one of ordinary skill in the art to modify the composition ratio of the claimed composition to form a composition with properties ideal for use as the channel of a switching device employed for use in a light emitting system (i.e., workfunction and transparency).

Regarding claims 15 and 17, the claims to a specific composition ratio of the claimed compound are considered to be an optimization of ranges. *In re Aller, Lacey, and Hall*, 105 USPQ 233 (CCPA 1955). It would have been obvious to one of ordinary skill in the art to modify the composition ratio of the claimed composition to form a composition with properties ideal for use as the channel of a switching device employed for use in a light emitting system (i.e., workfunction and transparency).

Regarding claim 40, Hamada et al., Phillips et al., Narushima et al., Minami and D disclose the semiconductor device of claim 39, wherein the one or more precursor compounds includes one or more precursor compounds that include E_x, wherein each E is selected from the group of Ga, In, Ge, Sn, Pb, each x is independently a non-zero number, and wherein each of A, B, C, D, and E are different (See rejection of claims 14 and 16 above, wherein the combination of Hamada et al., Phillips et al., Narushima et al., Minami and D is shown to disclose GaInGeSnPbO).

The claim to providing a precursor composition is a product by process limitation and is given no patentable weight so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of providing a precursor composition is therefore irrelevant given that the final product of the claim is anticipated by Hamada et al., Phillips et al., Narushima et al., Minami and D (See rejection of claims 14 and 16 above, wherein the combination of Hamada et al., Phillips et al., Narushima et al., Minami and D is shown to disclose GaInGeSnPbO).

Regarding claim 41, the claims to a method wherein depositing the channel includes vaporizing the precursor composition to form a vaporized precursor composition, and depositing the vaporized precursor composition using a physical vapor deposition technique including one or more of dc reactive sputtering, rf sputtering, magnetron sputtering, ion beam sputtering are product by process limitations and are given no patentable weight so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). This particular process of vaporizing the precursor composition to form a vaporized precursor composition, and depositing the vaporized precursor composition using a physical vapor deposition technique including one or more of dc reactive sputtering, rf sputtering, magnetron sputtering, ion beam sputtering is therefore irrelevant given that the final product of the claim is anticipated by Hamada et al., Phillips et al. and Narushima et al.

7. Claims 48-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akimoto (U.S. Patent # 6476788) in view of Hamada et al. (Japan Patent # JP405251705A) in view of Phillips et al. ("Transparent Conducting Thin Films of $GaInO_3$", Appl. Phys. Let. Vol. 65 (1), July 1994) further in view of Narushima et al. ("Electronic structure and transport properties in the transparent amorphous oxide semiconductor 2 CdOGeO", Phys. Rev. B 66, 035203-1, 7/16/2002).

Regarding claim 48, Figs. 1-3 of Akimoto discloses a display device, comprising:

a plurality of pixel devices (Akimoto, Col. 5, Lines 15-21) configured to operate collectively to display images (Akimoto, Col. 5, Lines 48-54), where each of the pixel devices includes a semiconductor device 28 (Akimoto, Col. 5, Lines 15-21) configured to control light emitted by the pixel device (see Fig. 2 of Akimoto), the semiconductor device including:

a channel (300) contacting a drain (4, 5) and a source (2, 3);

a gate electrode (1); and

a gate dielectric (12) positioned between the gate electrode (1) and the channel (300) and configured to permit application of an electric field to the channel (see Fig. 3C of Akimoto).

Akimoto, however, fails to disclose the specifics of the semiconductor device as are claimed.

Hamada et al. teaches a similar semiconductor device wherein a semiconductor device in a display device includes a drain electrode 10, a source electrode 11, a channel (8) contacting the drain electrode (10) and the source electrode (11), wherein the channel includes one or more compounds of the formula $A_xB_xO_x$, wherein the one or more compounds includes ITO (InSnO)),

a gate electrode 9, and a gate dielectric 3 positioned between the gate electrode 9 and the channel 8 and configured to permit application of an electric field to the channel (see Fig. 4 of Hamada et al.).

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the specific properties of the device of Hamada et al. into the device of Akimoto. The ordinary artisan would have been motivated to modify Akimoto in the above manner for the purpose of building a switching device for driving a photoelectric transducer wherein the properties of said device are not influenced by light (Paragraph 1, Hamada et al.).

Akimoto and Hamada et al., however, fail to disclose that compounds include gallium-tin oxide or that the compounds forming the channel region include one of an amorphous form and a mixed-phase crystalline form or that each x in the formula $A_xB_xO_x$ is independently a non-zero number.

Phillips et al. teaches the use of $GaIn_{1-x}Sn_xO_3$ (wherein each x in the formula is independently a non-zero number) (Page 115, Bridging Paragraph) as a replacement for a layer of ITO.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the $GaIn_{1-x}Sn_xO_3$ layer of Phillips et al. into the device of Akimoto and Hamada et al. The ordinary artisan would have been motivated to modify Akimoto and Hamada et al. in the above manner for the purpose of further lowering the conductivity of the transparent oxide semiconductor channel region of Akimoto and Hamada et al. and increasing the transparency of the transparent oxide semiconductor channel region. (Hamada et al., Paragraph 25) (Phillips et al., Page 117, Final Paragraph)

Akimoto, Hamada et al. and Phillips et al., however, fail to disclose the channel region including one of an amorphous form and a mixed-phase crystalline form.

Narushima et al. teaches that it is desirable to use amorphous transparent oxide as a semiconductor material (Narushima et al., Col. 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize an amorphous transparent oxide as is taught by Narushima et al. in the device of Akimoto, Hamada et al. and Phillips et al. The ordinary artisan would have been motivated to modify Akimoto, Hamada et al. and Phillips et al. in the above manner for the purpose of taking advantage of the high electron mobility associated with the amorphous transparent oxides and the ability of amorphous transparent oxides to be deposited on plastic, flexible substrates (Narushima et al., Col. 1).

Regarding claim 49, Akimoto, Hamada, Phillips et al. and Narushima et al. disclose the display of claim 48, wherein the source (11), drain (10), and gate (6) electrodes include a substantially transparent material (ITO) (see Fig. 4 of Hamada et al. for citations).

Regarding claim 50, Akimoto, Hamada, Phillips et al. and Narushima et al. disclose the device of claim 48, wherein the one or more compounds of the formula $A_xB_xO_x$ includes an atomic composition of metal (A)-to-metal (B) ratio of A:B, wherein proportions of A and B, based on stoichiometric x values associated with A and B are in a range of about .05 to .95 (Phillips et al. discloses $GaIn_{1-x}Sn_xO_3$ (0<=x<=20), which satisfies the limitations of this claim).

Regarding claim 51, Akimoto, Hamada, Phillips et al. and Narushima et al. disclose the display of claim 48, wherein the one or more compounds of the formula $A_xB_xO_x$ includes C_x, wherein C is Indium ($GaIn_{1-x}Sn_xO_3$)(Phillips et al., Page 115, Bridging Paragraph)

Regarding claim 52, Akimoto, Hamada et al., Phillips et al. and Narushima et al. disclose the device of claim 51, wherein the one or more compounds of the formula $A_xB_xC_xO_x$ includes an atomic composition of metal (A)-to-metal (B)-to-metal (C) ratio of A:B:C, wherein proportions of A, B and C, based on stoichiometric x values associated with A, B and C are in a range of about .05 to .95 (Phillips et al. discloses $GaIn_{1-x}Sn_xO_3$ (0<=x<=20), which satisfies the limitations of this claim).

8. Claims 53 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akimoto (U.S. Patent # 6476788) in view of Hamada et al. (Japan Patent # JP405251705A) in view of Phillips et al. ("Transparent Conducting Thin Films of $GaInO_3$", Appl. Phys. Let. Vol. 65 (1), July 1994) further in view of Narushima et al. ("Electronic structure and transport properties in the transparent amorphous oxide semiconductor 2 CdOGeO", Phys. Rev. B 66, 035203-1, 7/16/2002) further in view of Minami ("Transparent and Conductive Multicomponent Oxide films prepared by magnetron sputtering", Minami, J. Vac. Sci. Technol. A 17(4), Jul/Aug 1999).

Regarding claim 53, Akimoto, Hamada et al., Phillips et al. and Narushima et al. disclose the semiconductor device of claim 51, but fail to specifically disclose the limitations added by claim 53.

Phillips et al., however, does disclose that both GaGeInO and GaInSnO are transparent conducting oxides with desirable properties (more transparent then other known TCOs).

Minami teaches that a transparent conducting oxide will always be obtained when combining oxides which are TCO film materials or transparent conductors.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Minami into the devices of Akimoto, Hamada et al., Phillips et al. and Narushima et al. and combine the GaGeInO and GaInSnO of Phillips et al. to form a new multicomponent oxide. The ordinary artisan would have been motivated to modify Akimoto, Hamada et al., Phillips et al. and Narushima et al. in the above manner for the purpose of creating a new multicomponent oxide suitable for use as the channel of a switching device employed for use in a light emitting system because of its specific electrical, optical and chemical properties and its specific bandgap energy and workfunction, which can be controlled by altering the chemical composition (Minami, Conclusion).

The claims to a specific composition ratio of the claimed compound are considered to be an optimization of ranges. *In re Aller, Lacey, and Hall*, 105 USPQ 233 (CCPA 1955). It would have been obvious to one of ordinary skill in the art to modify the composition ratio of the claimed composition to form a composition with properties ideal for use as the channel of a switching device employed for use in a light emitting system (i.e., workfunction and transparency).

Regarding claim 54, the claims to a specific composition ratio of the claimed compound are considered to be an optimization of ranges. *In re Aller, Lacey, and Hall*, 105 USPQ 233

(CCPA 1955). It would have been obvious to one of ordinary skill in the art to modify the composition ratio of the claimed composition to form a composition with properties ideal for use as the channel of a switching device employed for use in a light emitting system (i.e., workfunction and transparency).

9. Claims 55 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akimoto (U.S. Patent # 6476788) in view of Hamada et al. (Japan Patent # JP405251705A) in view of Phillips et al. ("Transparent Conducting Thin Films of $GaInO_3$", Appl. Phys. Let. Vol. 65 (1), July 1994) further in view of Narushima et al. ("Electronic structure and transport properties in the transparent amorphous oxide semiconductor 2 CdOGeO", Phys. Rev. B 66, 035203-1, 7/16/2002) further in view of Minami ("Transparent and Conductive Multicomponent Oxide films prepared by magnetron sputtering", Minami, J. Vac. Sci. Technol. A 17(4), Jul/Aug 1999) further in view of D ("Transparent Conducting PbO_2 films prepared by activated reactive evaporation", Phys. Rev. B 33,2660 - 2664 (1986)).

Regarding claim 55, Akimoto, Hamada, Phillips et al., Narushima et al. and Minami disclose the semiconductor device of claim 53, but fail to disclose the one or more compounds of formula $A_xB_xC_xD_xO_x$ including E_x, to form a compound of the formula $A_xB_xC_xD_xE_xO_x$, wherein each E is selected from the group of Ga, In, Ge, Sn, Pb, each O is atomic oxygen, each x is independently a non-zero number, and wherein each of A, B, C, D, and E are different.

D discloses a transparent conductive oxide semiconductor of PbO_2.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the PbO_2 of D into the device of Akimoto, Hamada, Phillips et al., Narushima et

al. and Minami and combine the PbO_2 of D into the GaGeInSnO of Akimoto, Hamada, Phillips et al., Narushima et al. and Minami to form a new multicomponent oxide (GaGeInSnPbO). The ordinary artisan would have been motivated to modify Akimoto, Hamada, Phillips et al., Narushima et al. and Minami in the above manner for the purpose of creating a new multicomponent oxide suitable for use as the channel of a switching device employed for use in a light emitting system because of its specific electrical, optical and chemical properties and its specific bandgap energy and workfunction, which can be controlled by altering the chemical composition (Minami, Conclusion). The ordinary artisan would have expected a reasonable degree of success in this combination because Minami teaches that a transparent conducting oxide will always be obtained when combining oxides which are TCO film materials or transparent conductors.

The claims to a specific composition ratio of the claimed compound are considered to be an optimization of ranges. *In re Aller, Lacey, and Hall*, 105 USPQ 233 (CCPA 1955). It would have been obvious to one of ordinary skill in the art to modify the composition ratio of the claimed composition to form a composition with properties ideal for use as the channel of a switching device employed for use in a light emitting system (i.e., workfunction and transparency).

Regarding claim 56, the claims to a specific composition ratio of the claimed compound are considered to be an optimization of ranges. *In re Aller, Lacey, and Hall*, 105 USPQ 233 (CCPA 1955). It would have been obvious to one of ordinary skill in the art to modify the composition ratio of the claimed composition to form a composition with properties ideal for use

as the channel of a switching device employed for use in a light emitting system (i.e., workfunction and transparency).

Response to Arguments

10. Applicant's arguments regarding the rejection of claims 1-20, 37-44 and 48-56 under 35 U.S.C. 112, second paragraph, are not found to be persuasive. The Examiner again asserts that a formula of the form $A_xB_xO_x$ inherently possesses a ratio of the values of x (1:1:1), and the values of x cannot, by their very nature be considered to be independent, nor can they be considered to have a ratio other than 1:1:1. Examiner argues that the claim limitation "each x is independently a non-zero number", does not clarify the claim. The limitation in question ("each x is independently a non-zero number") could be interpreted, for instance, to mean that each of the subscript values are determined independently, but still could all be the same value, i.e., the term "independent" is not synonymous with "different". Applicant specifically argues that the specification clarifies that "the value of "x" for each of the constituent elements may be different". The Examiner agrees that such a limitation would clarify the instant claims, but as this limitation is not included in the instant claims, the Examiner determines that the instant claims remain indefinite.

Applicant's arguments with respect to all claims have been considered but are not found persuasive. Applicant argues that the previously cited references do not disclose the device as claimed. The Examiner argues that said references do indeed disclose the device as claimed, as is outlined in the rejection above.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to William Kraig whose telephone number is 571-272-8660. The examiner can normally be reached on Mon-Fri 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Parker can be reached on 571-272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

WFK
10/24/2007

EUGENE LEE
PRIMARY EXAMINER